

## PATENT SPECIFICATION

DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

Improvements in or relating to Self-propelled Machines  
for Cleaning the Walls of Underground Passages

We, LE MATERIEL DE VOIRIE, a French Company organized under the laws of France, of 156, rue Ammand Sylvestre, Courbevoie (Seine), France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to machines for cleaning the vertical or horizontal walls of underground passages or subways as well as the vaults of various types of underground passages, and it is the chief object of this invention to provide a device capable of performing all the steps of this cleaning operation by using a cylindrical brush or like sweeper.

It is known that a rectilinear brush permits of sweeping a convex or concave surface, provided that the rise of the curve is small enough to be easily compensated by the flexibility of the brush bristles or like elements. Thus, the brushes of street-sweepers operate satisfactorily over widths up to six or seven feet in spite of the transverse camber of the road surface, but when this camber exceeds a certain limit the efficiency of the end portion or the central portion of the brush is impaired, according as the road surface is respectively convex or concave.

Similarly, when a machine of this character is used for cleaning the vaults of subways, and up to a certain degree of curvature of the vault, it is possible to utilize a brush extending at right angles to the generatrices of this vault to clean a strip corresponding in width to the length of the cylindrical brush. When the brush is used for cleaning connecting curved surfaces of relatively small radius it cannot be operated with its axis at right angles to the vault generatrices and therefore the brush must be set obliquely so

that the width swept thereby on the vault surface is reduced while increasing concurrently the radius of curvature of the vault line registering with the working generatrix of the brush proper. The device of this invention is operated according to this procedure and permits of selecting for each vault element or section a working angle such that the radius of the line of contact of the cylindrical brush with the subway vault is kept at a value sufficient to permit the efficient operation of the brush throughout its length.

According to the invention there is provided a self-propelled machine for cleaning the walls of underground passages comprising a jib mounted on the machine for luffing motion in a vertical plane, a turret support pivotally mounted on the jib, a turret rotatably mounted on the support, an arm mounted on the turret so that it can oscillate about its transverse axis perpendicular to the axis of rotation of the turret and a cylindrical brush rotatably mounted on the arm capable of freely pivoting in a plane perpendicular to the longitudinal axis of the arm.

In addition, a machine according to the invention may be provided with a combination of means adapted to maintain a constant brush pressure against the wall to be cleaned, irrespective of the position and orientation of this brush. A first arrangement provided to this end consists in mounting the brush supporting strap or casing on one end of an arm pivotally mounted intermediate its ends and carrying a balance or counterweight at its other end so that it preserves a state of neutral equilibrium irrespective of its orientation with respect to the ground. The contact pressure necessary for cleaning the wall is obtained by means of a pneumatic actuator or cylinder fed from a pressure-

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reducing device yielding a constant control pressure irrespective of the position of the movable assembly about its axis. This working-pressure regularizing arrangement is also  
 5 advantageous in that it compensates automatically, that is, without requiring any complementary manual adjustment, the difference likely to arise in the distance between the road surface and the overlying vault to be swept.  
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A machine according to the invention may also be provided with means to avoid the inconveniences likely to result from the fact that the machine is driven along a path not  
 15 strictly parallel to the vault generatrices, which would normally interfere with the regularity of the sweeping action produced by the brush on the vault. To this end, the angular position of the brush axis with respect to a pivot axis about which it is adapted to rotate may be controlled by a hydraulic motor permitting a free movement of rotation when it is not fed with hydraulic fluid under pressure.  
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Thus, under any circumstances the machine constructed according to the teachings of this invention will provide a regular engagement of the brush throughout its length with the wall to be cleaned under a constant unitary surface pressure of the brush.  
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The function of the operator of this device consists simply in providing a rough adjustment of the brush position by means of the controls provided therefor, the fine adjustment being completed automatically as long as the work proceeds on a vault portion having a constant contour.  
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A typical form of embodiment of the present invention will be described herebelow by way of example with reference to the attached drawing of which the single figure illustrates diagrammatically the various possible positions of the brush with respect to the supporting frame structure.  
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The frame 1 of the self-propelled vehicle carries a slewing platform 2 on which are pivotally mounted a jib 3 and a hydraulic cylinder 4 controlling the luffing motion of the jib.  
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Pivotally mounted on the upper end of jib 3 is a turret support 5 of which the pivotal movements are controlled by a hydraulic cylinder 6 reacting against the jib 3. The turret support 5 carries a hydraulic motor 7 having keyed on its shaft a pinion 8 meshing with a toothed annulus 9 rigid with a turret 10 for rotating this turret 10 in relation to the turret support 5 while permitting its free rotation when no compressed fluid is fed to the motor 7. Pivotally mounted in bearings on the end of said turret 10 is an arm 11 carrying at one end a cylindrical brush 12 having its axis parallel to the pivot axis of said arm and at the  
 60 65 opposite end a balance or counterweight 13

providing a state of neutral equilibrium for said arm 11 with respect to the turret 10. Another hydraulic motor (not shown) is provided for rotatably driving the brush 12 and a compressed-air cylinder 14 is also provided for resiliently setting the angular position of the arm 11 in relation to the turret 10.  
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The combination of the slewing motion of the platform on the frame 1 with the luffing motion of the jib on the platform provides a considerable range of action for the operator of the machine about the frame 1. Thus, the lateral walls, the vault and certain horizontal wall portions of an underground passage of relatively large transverse dimensions can be cleaned without difficulty.  
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The combination of the rotary motion of the turret support 5 on the end of jib 3 with the rotation of the turret 10 in relation to the turret support 5 enables the operator of the machine to set the axis of the cylindrical brush 12 in any desired angular position. Notably, in the case of wall sections having a relatively pronounced transverse curvature, the operator may incline the axis of brush 12 towards the longitudinal direction by reducing to a suitable value the curvature of the wall line along which the working generatrix of this cylindrical brush is placed.  
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The elastic pressure exerted by the brush 12 against the wall during the cleaning operation is provided by the pneumatic cylinder 14 thus automatically ensuring the continuity of the contact between the brush and the wall during the travelling motion of the vehicle without requiring a constant actuation of the hydraulic controls. Moreover, the pressure exerted by the brush on the wall is substantially constant so that the brush operates with the maximum efficiency and the minimum wear of its bristles, points or like elements.  
 100 105

The assembly comprising the turret 10 and arm 11 follows automatically without requiring the operator's attention the minor unevennesses occurring on the surface being cleaned with respect to the machine travel. In fact, due to the specific type of hydraulic motor used for controlling the rotation of turret 10 in relation to its support 5, the assembly comprising the turret 10, brush-carrier arm 11 and brush proper 12 can revolve freely about the pivotal mounting of the turret support outside the periods in which the controls are operated by the operator of the machine.  
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Although the present invention has been described in conjunction with a preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifica-  
 125 130

tions and variations are considered to be within the purview and scope of the invention and appended claims.

WHAT WE CLAIM IS:—

- 5 1. A self-propelled machine for cleaning the walls of underground passages comprising a jib mounted on the machine for luffing motion in a vertical plane, a turret support pivotally mounted on the jib, a turret rotatably mounted on the support, an arm mounted on the turret so that it can oscillate about its transverse axis perpendicular to the axis of rotation of the turret and a cylindrical brush rotatably mounted on the arm capable of freely pivoting in a plane perpendicular to the longitudinal axis of the arm.
- 10 2. Machine according to claim 1, characterised in that the angular movements of the jib on the platform and of the turret support on the jib as well as the rotation of the turret and of the cylindrical brush
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are controlled by hydraulic means and the pivotal movements of the brush-supporting arm are controlled by pneumatic means.

3. Machine according to claim 2, characterised in that said hydraulic motor controlling the rotation of the turret becomes completely inoperative when no hydraulic fluid under pressure is supplied thereto, thus permitting the free rotation of the assembly comprising the turret, arm and brush with respect to the turret support.

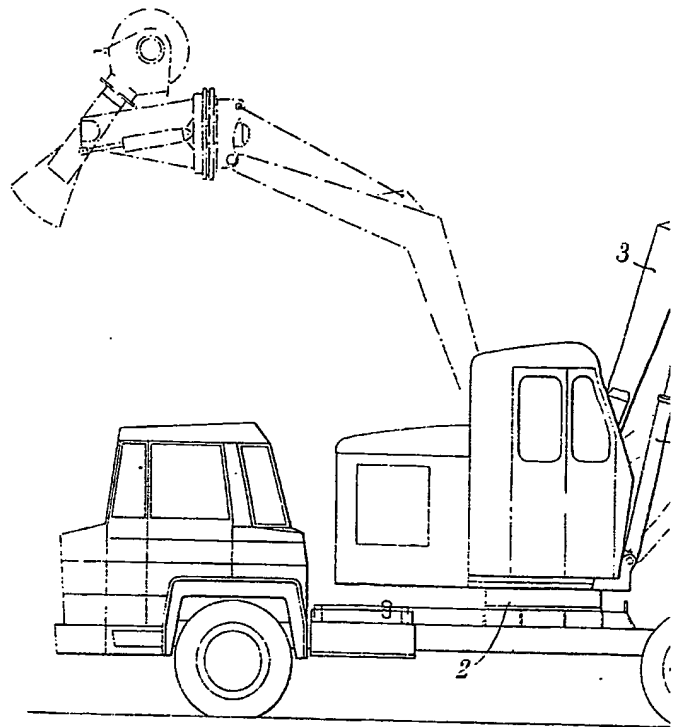
4. Machine substantially as described hereinabove and illustrated in the accompanying drawing.

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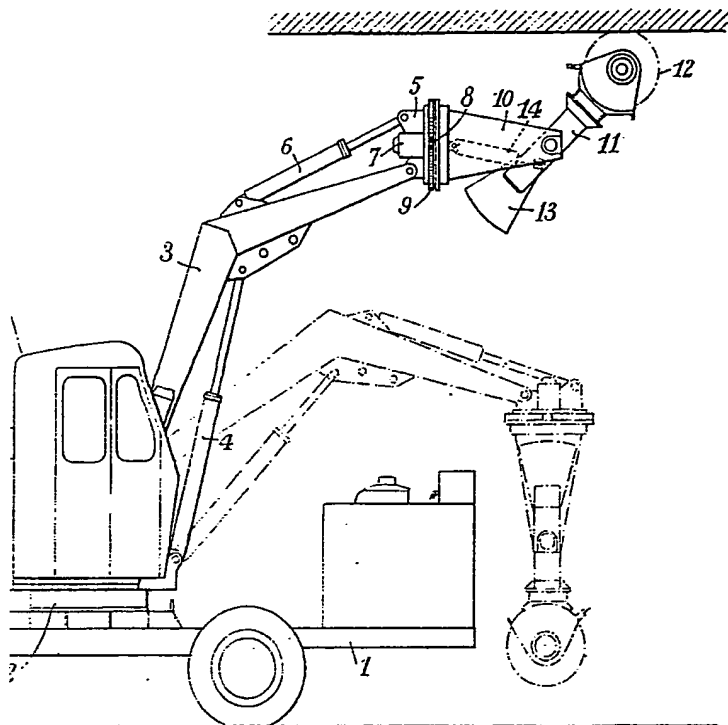
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